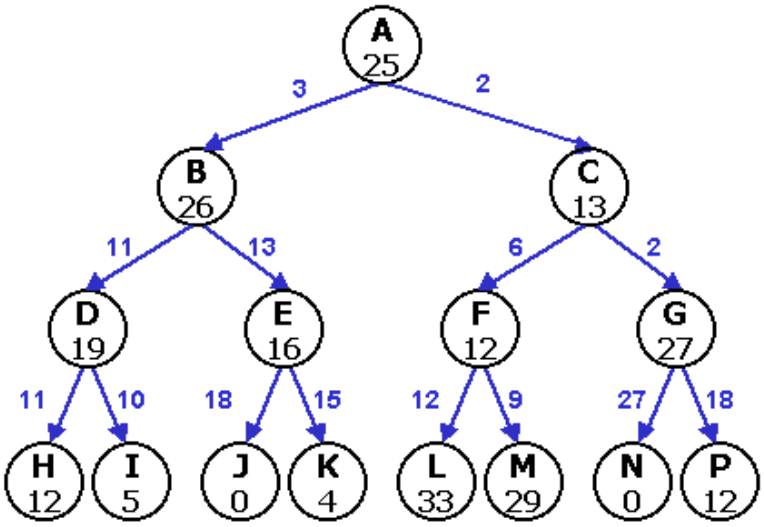
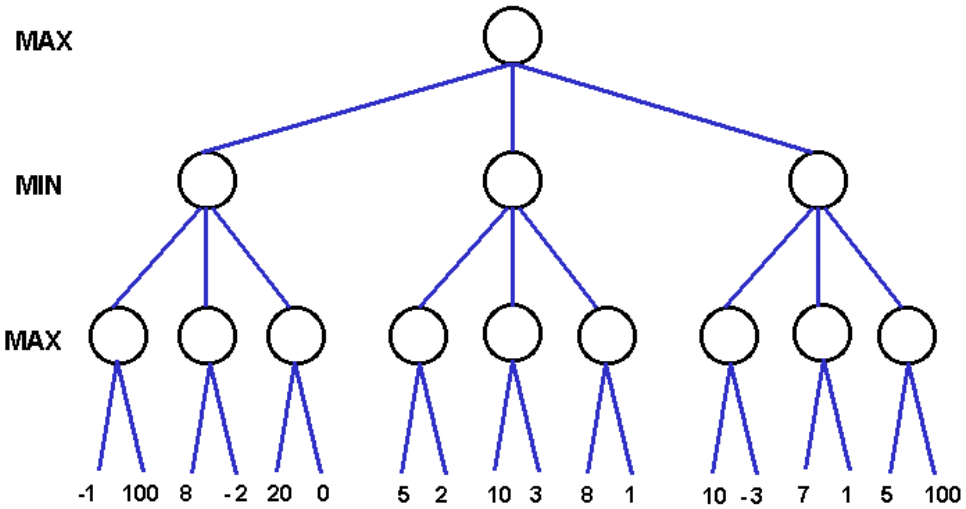
Search Exercise

(a) A search tree is shown below where each circle represents a node corresponding to a state in the search space. The estimated cost (i.e. *h* function) for finding a solution from a node is shown in its circle. The two nodes with *h* = 0 are goal states and the other terminal nodes are dead-ends. Actual link costs are marked on the links between the nodes. Thus the path cost (i.e. *g* function) of a node is equal to the sum of the link costs from the root to that node.



Using the greedy search algorithm, give the sequence of nodes expanded before a goal state is reached. What is the solution path and what is its path cost?

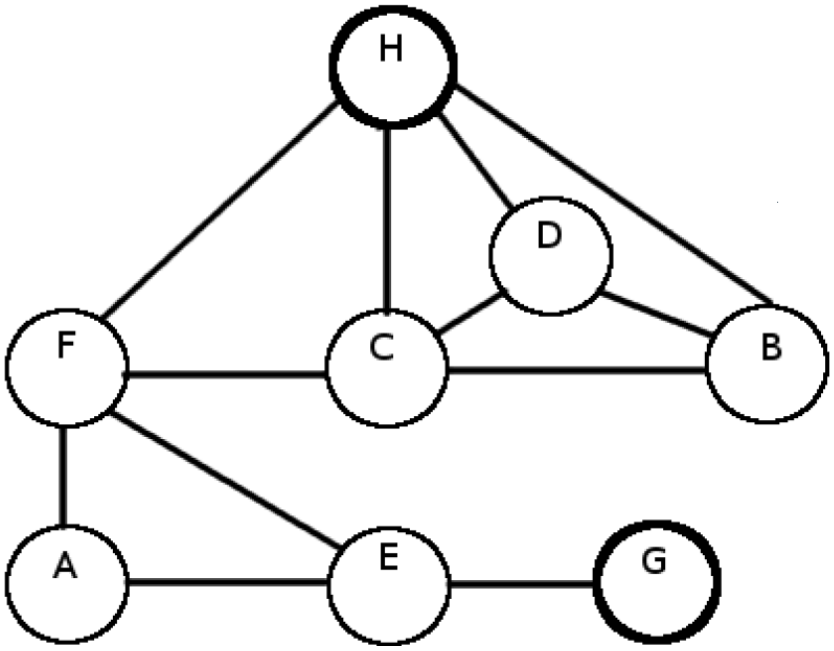
(b) Consider the MIN-MAX game tree given below.



i) Fill in the utility function values at each node [the blank circles] in the MIN-MAX tree above, and mark the first move path, from the root node with a thick line.

ii) Cross out the branches that are pruned by α-β pruning. How many nodes did you not have to visit with α-β pruning when compared to the full MIN-MAX search above? Show all intermediate values at each node as they get updated.

(c) An alien has changed his name to "Ford Prefect" when he came to Earth because he thought he would blend in with the dominant life forms. Ford's friend needs a new name too. Ford suggests he start with "Ford Mustang". The friend decides to use his 6.034 search skills to navigate through a sea of choices to find a good name. The friend is now faced with the graph shown below



Note: In all search problems, use alphabetical order to break ties when deciding the priority to use for extending nodes.

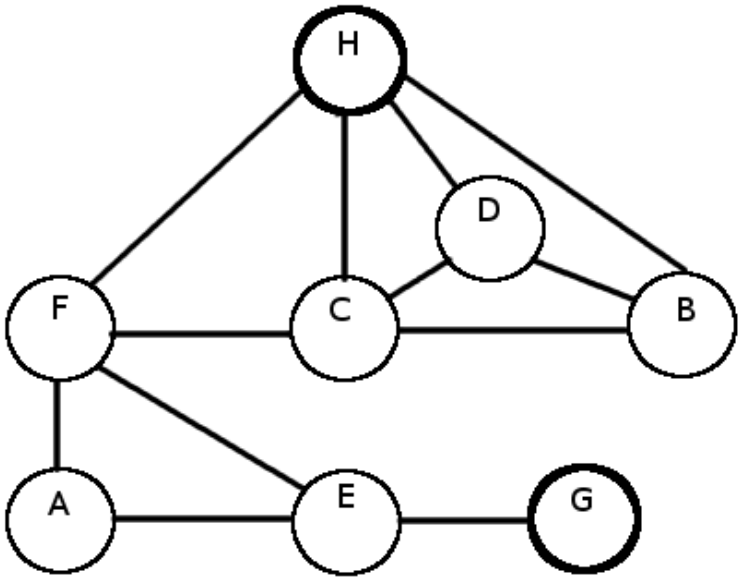
i. Starting at node **H**, find the Depth-First Search (DFS) path to **G**. Draw the DFS tree to show how you arrive at this solution

ii. How many times do you encounter loops during your search? State all paths in your search that contain loops

(d) Use the depth-first search to find ALL possible paths from the root node **H** to the goal node **G**

i. Draw the tree for this search

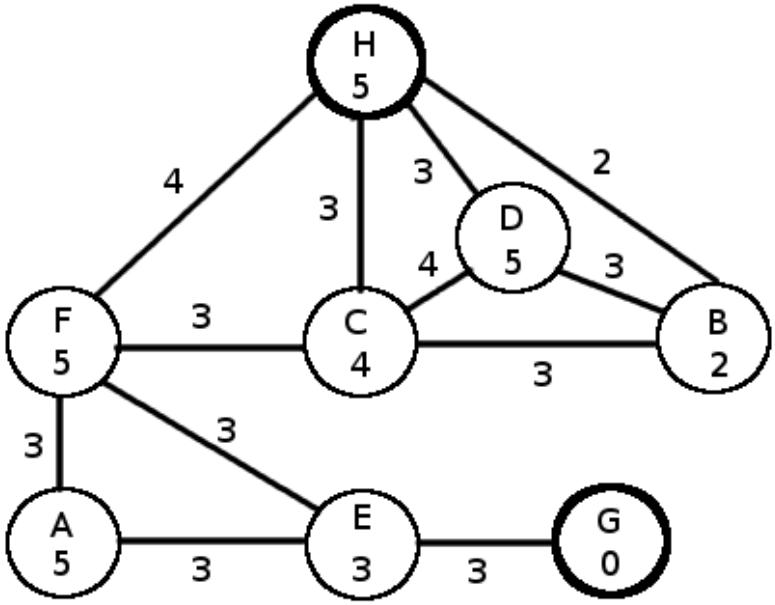
ii. List ALL possible paths



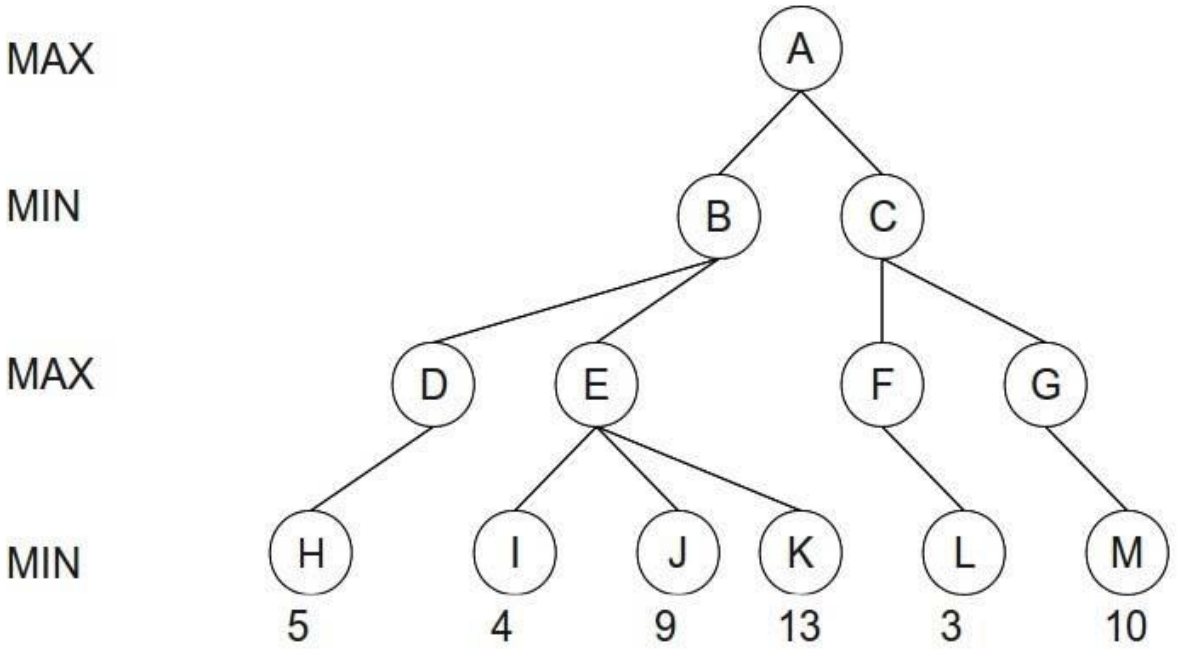
(e) Use the A* search to find the path from the root node to the goal node. Straight-line distances from each node to the goal node are indicated within the nodes

i. Draw the corresponding tree and show your work

ii. Path from root to goal



(f) Consider the following tree.



i. Perform Minimax on this tree. Write the minimax value associated with each node inside the node, next to its corresponding node letter. Indicate the direction/move that the agent should take

ii. Perform Alpha Beta search on this tree. Indicate pruning by striking through the appropriate edge(s). Mark your steps by indicating both the temporary and final alpha and beta values next to each node